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# **Mapping of Themes Pertaining to Operations Management**: a Refined Analysis Based on the Perceptions of Researchers, Lecturers and Practitioners

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## ABSTRACT

An article published at Revista de Gestão (REGE), an academic journal by the University of Sao Paulo, in 2013, proposed the mapping of Operations Management themes based on the editorial space provided in major journals and conference proceedings in the area. Based on such proposal, the current study conducted a survey to capture the importance assigned to those themes by researchers, lecturers and practitioners and how they categorized the themes into broader groupings. A factor analysis was performed with the data collected by means of the survey and several statistical tests were also carried out in order to assess the strength of the constructs and to confirm the dimensions proposed in the referred mapping of Operations Management themes, allowing for its refinement. The factor analysis resulted in nine factors, seven of which very closely resemble the constructs presented in the previous paper. Thus, the results obtained herein confirm most of the previously obtained mapping, providing a further step in the discussion of the themes that are relevant to the area of Operations Management.

**Keywords:** Themes. Operations management. Mapping.

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## 1 INTRODUCTION

The practice of mapping themes based on topics defined as recommendations for authors by international journals of reference has been used by several authors in scientific studies in Operations Management (SCUDDER; HILL, 1998; ARKADER, 2003; CORREA; PAIVA; PRIMO, 2010; PAIVA; BRITO, 2013; PEINADO; GRAEML, 2014). According to Godinho Filho, Fernandes and Lima (2009, p. 163), "the importance of classifications for the scientific activity is clear: scientific knowledge is based on classification". Therefore, many researchers have made efforts to map and create classifications and taxonomies.

An article published at Revista de Gestão (REGE), an academic journal by the University of Sao Paulo, proposed the mapping of Operations Management themes based on the editorial space provided in major journals and conference proceedings in the area (PEINADO; GRAEML, 2013). Based on such proposal, the current study conducted a survey to capture the importance assigned to those themes by researchers, lecturers and practitioners and how they categorized the themes into broader groupings. A factor analysis was performed with the data collected by means of the survey and several statistical tests were also carried out in order to assess the strength of the constructs and to confirm the dimensions proposed in the referred mapping of Operations Management themes, allowing for its refinement. This procedure seemed reasonable, because it could help one verify if those who deal with Operations Management in their professional lives agreed with the editors of the area's academic journals with respect to the categorization of its most relevant themes.

From a theoretical perspective, the development of this study is justified because it advances and deepens the previous study. It provides a better understanding of the themes pertaining to the field of Operations Management as perceived by those who work in the area, developing research, teaching its concepts to future generations of company managers, or acting directly in the management of industrial operations. From a practical point of view, the refinements to the mapping of Operations Management themes proposed by Peinado and Graeml (2013) can be used as a guideline for researchers, lecturers and practitioners in the field, to reflect and define their everyday actions.

## 2 THEORETICAL BECKGROUND

### 2.1 THE PRACTICE OF MAPPING AND CLASSIFYING STUDY THEMES

Surveys on scientific research require some form of thematic classification that allows the themes covered by the studies published in a particular area to be mapped. Many authors prefer to use pre-existing categorizations as a basis for mapping the themes within their areas of study.

The first issue of Revista de Administração de Empresas (RAE) of 2013 brought the results of a forum on the Brazilian scientific production in the field of Business Administration for the first decade of this century (BERTERO *et. al.*, 2013). Five papers were published there that, in addition to other findings and recommendations, map the themes that were discussed in the papers published in the country's scientific journals for the following areas: Organizational Behavior (SOBRAL; MANSUR, 2013), Human Resource Management (MASCARENHAS; BARBOSA, 2013), Finance (LEAL *et. al.*, 2013), Operations Management (PAIVA and BRITO, 2013) and Marketing (MAZZON; HERNANDEZ, 2013).

Beuren *et al*. (2007) used the thematic classification proposed by ANPAD [Associação Nacional de Pós-Graduação e Pesquisa em Administração (the National Association of Graduate Studies and Research in Administration)] in a survey on the comptrollership approach found in papers published in EnANPAD and in the University of Sao Paulo's Conference in Comptrollership and Accounting from 2001 to 2006. Cardoso *et al.* (2007) also used the thematic classification proposed by ANPAD in a profile analysis of the cost accounting studies presented in EnANPAD between 1998 and 2003.

In an analysis of the scientific research in information systems produced between 1990 and 2003, Hoppen and Meirelles (2005) structured a mapping framework for the addressed themes following a classification scheme for the IS literature proposed by Barki *et al.* (1993) consisting of nine main themes. These authors, in turn, recalled that "in June 1988 MIS Quarterly published a classification scheme of IS keywords. The development of this scheme was intended to provide a description of the discipline, introduce a common language, and enable research of the field's development" (BARKI *et al.* 1993, p. 209).

In an analysis of the scientific research produced between 1990 and 2003 in accounting, Cardoso *et al.* (2005) developed a thematic classification system composed of eleven main themes, which was adapted from the topics proposed by the AAA (American Accounting Association) and the EAA (European Accounting Association). According to these authors, it

is important to map the knowledge of academic papers published in a particular area because it enables the evaluation and reflection about these works.

In another analysis of the national and international scientific publications on franchising produced between 1998 and 2007, Melo and Andreassi (2010) developed their own thematic classification system, consisting of 24 main themes. The authors found that the Brazilian scientific production could be framed in only nine themes, while the international scientific production needed a mapping base of nineteen themes.

In another study that analyzed the Brazilian scientific production between 1991 and 2002 regarding business strategy, Bertero, Vasconcelos and Binder (2003) also developed their own thematic classification system for the addressed subjects, with an initial mapping consisting of ten themes. According to the authors, this first mapping was unable to frame the entirety of the themes addressed in 101 articles out of a total of 303 analyzed articles. Thus, a new classification was developed that included fourteen additional themes.

Martinez (2013) reviewed the recent academic literature about results management in Brazil with the purpose of identifying the main research themes in the Brazilian context and the results that interested users, regulators and those who prepare financial demonstrations.

## 2.2 THE PRACTICE OF MAPPING AND CLASSIFYING STUDY THEMES IN OPERATIONS MANAGEMENT

The mapping and classification of themes specifically concerning the field of Operations Management have occupied many researchers over the years. Scudder and Hill (1998) used the themes adopted by the Journal of Operations Management (JOM) as a basis for a mapping of the themes addressed in empirical studies on Operations Management published in thirteen journals between 1986 and 1995. These authors consider that the classification of the published articles into themes allows the identification of topics that concern Operations Management and the extent to which they are being developed. Arkader (2003), analyzing the scientific production in Operations Management in Brazil, also mapped the themes addressed in the surveyed articles based on a list of topics, tools and approaches previously suggested by JOM. It should be highlighted here that the list of JOM's topics, which was used as an initial reference by the above mentioned authors, is not divided in sub-areas comprising the themes included in the mapping. This could make it difficult to work on constructs for the refinement of the list and confirmation of such constructs by means of statistical methods such as factor analysis.

Still considering meta-studies that involve some sort of mapping of Operations Management themes, Correa, Paiva and Primo (2010) searched for the themes discussed by Brazilian researchers in prestigious foreign journals of the field, among which: Journal of Operations Management (JOM), Production and Operations Management (POM), International Journal of Operations and Production Management (IJOPM) and International Journal of Production Economics (IJPE). The authors created their own listing which included seven themes: Production programing, Operations strategy, Supply chain management, Operations performance, Product development, Operations and service and, Quality management. More recently, Paiva and Brito (2013) also mapped the themes and research methods used by Brazilian researchers in the Operations Management area, considering the last ten years of the main Business Administration journals and the most relevant international journals in the field of Operations Management. The authors generated two listings of themes, the first one for the research themes found in national publications, comprising seven themes (Supply chain management, Operations strategy, New products development, Service operations, Quality management, Sustainable operations, and Teaching) and the second for research themes that appeared in international publications, comprising eight themes (Production planning, Operations strategy, Supply chain management, Product development, Operations performance, Service operations, Quality management, Product variety management). The three lists of topics, suggested by Correa, Paiva and Primo (2010) and Paiva and Brito (2013) do not organize the themes in larger areas, either, including sub-areas for the themes in the mapping. As mentioned before, this could make it more difficult to refine constructs and confirm them by means of factor analysis and other statistical methods.

Still considering studies that involved discussing the themes that pertain Operations Management, Graeml and Peinado (2013) used the mapping of themes that is now being refined in order to analyze the space occupied by Operations Management courses as part of undergraduate Business programs in Brazil. That same mapping was used by Peinado and Graeml (2014) as the base to identify the Operations Management themes that were valued the most by automakers, in defining their operations processes.

This brief literature review intended to show the relevance of having a mapping of themes pertaining Operations Management that can be shared by those working in the area, the refinement of which could be obtained by means of statistical methods applied to the research participants impressions about each of such themes.

## 3 METHODOLOGICAL PROCEDURES

The survey participants were asked to answer a questionnaire with Likert-scale questions sent via email. The questionnaire consisted of 45 questions designed to cover the various themes of Operations Management, as identified in the mapping proposed by Peinado and Graeml (2013). This questionnaire attempted to understand the importance given to these themes by researchers, lecturers and practitioners but also sought to confirm the "thematic dimensions" of the original mapping through a factor analysis, adopting a procedure similar to that of Tan and Wisner (2003). These authors collected data through a survey consisting of 44 questions using a Likert scale. The responses were subjected to factor analysis leading to the emergence of four primary themes: supplier assessment practices, new product development practices, just-in-time (JIT) practices and quality practices. Perhaps the main difference between the study by Tan and Wisner (2003) and the one described in this article is that those authors considered only the importance of each theme according to senior managers in the manufacturing industry, whereas the present study also collected information from scholars who study and teach Operations Management.

The 45 questions in the present study pertained to ten of the eleven major themes presented in the consolidated thematic mapping proposed by Peinado and Graeml (2013): (1) Operations strategy, (2) Routine operations management, (3) JIT – Lean manufacturing, (4) Quality management, (5) Logistics and supply chain; (6) Ergonomics and work organization; (7) Environmental sustainability of operations, (8) Project management and product development; (9) Innovation and technology management, and (10) Service operations. The last category of the original themes mapping (Teaching and research in Operations Management) was not included in the questionnaire because it is not a thematic category *of* the area, but *on* the area, which reduces its importance to practitioners, although it remains valuable to researchers and lecturers.

For each question, the respondents were asked to explain the degree of perceived importance for a topic; importance was determined by means of a seven-point Likert scale, as previously mentioned, ranging from "little important" to "extremely important", as shown in the Appendix. Respondents were instructed to leave the item blank if they had no formed opinion or were unaware of the topic.

One intention of the survey was to generalize the results through a quantitative analysis of collected data, as suggested by Babbie (2001).

Face validity was obtained through a pre-test of the questionnaire with respondents who occupy Operations Management positions in their companies. A group of fifteen respondents was used for this purpose, comprising eight professionals with management degrees and seven with production engineering degrees. It was felt that there was no need to validate the survey questions with researchers and lecturers because the survey was structured almost directly from the consolidated thematic mapping presented by Peinado and Graeml (2013), which had its origin in academic journals. Nevertheless, a pilot test was conducted with seventy lecturers to determine the dispersion of answers along the Likert scale.

## 3.1 STUDY SAMPLE

### *Selection of researchers for the sample*

To compose the sample subgroup of researchers, 36 researchers who have published more than five articles on Operations Management themes in Brazilian academic journals of relevance, from 2001-2010, were invited to participate in the study, as this level of production suggests that they are quite involved and are knowledgeable of the themes in the area. Contact information for the researchers of this sample subgroup was obtained by consulting the Lattes curriculum of each one of them. Twelve researchers participated by answering the questionnaire, thus achieving a 33.3% response rate for the population of researchers who met the selection criteria.

### *Selection of lecturers for the sample*

For the composition of the subgroup of lecturers, lecturers of subjects related to Operations Management in undergraduate courses from 57 educational institutions were invited to participate based on three criteria. The first criterion sought to ensure the participation of lecturers from educational institutions that focused on scientific production in Operations Management, which is measured based on the number of articles published by researchers affiliated with the institutions in scientific journals of national relevance from 2001-2010. This selection criterion was considered to be appropriate due to the belief that educational institutions more prolific in scientific publication in the area of Operations Management offer Business Administration programs that consider Operations Management to be an important area for training their undergraduate students. Following this selection criterion, 61 lecturers were invited to participate, from whom 24 (39.3%) responded the questionnaire. The second criterion sought to include lecturers from Business Administration programs of recognized excellence. Thus, lecturers from all 27 Business Administration programs that achieved grade 5 in the Preliminary Program Rating (Conceito Preliminar de

Curso - CPC) from the National Institute for Educational Research and Studies (Instituto Nacional de Estudos e Pesquisas Educacionais – Inep) were invited to participate in the survey. It is noteworthy to say that the Inep assessment is currently the primary tool adopted by the Ministry of Education (Ministério da Educação – MEC) for measuring the quality of Business Administration programs. This selection criterion identified 137 lecturers, who were invited to participate in the study, and 56 (40.9%) responded the questionnaire. To address the third part of this sample group, lecturers from 20 Business Administration programs that achieved grade 3 in the CPC from Inep were invited to participate in the study. This third criterion aimed to allow the inclusion of average quality programs. Following this selection criterion, 52 lecturers were invited to participate, from whom eleven (21.2%) responded the questionnaire. These sample subgroups were used to identify any differences in perceptions among lecturers from programs with different profiles.

Lecturers of subjects directly related to Operations Management in the Business Administration programs selected for the study, based on the above criteria, were identified by means of a preliminary search on the programs' websites. When the subject taught by the lecturers was provided on the program's Internet page, the search and selection process ended there. However, in many cases, only the name of the lecturer was provided, which increased the investigative effort, requiring that the Lattes curriculum of all lecturers in the program be consulted to identify those who taught Operations Management subjects.

The 250 lecturers from the 57 institutions selected for the study were contacted through the link provided in the Lattes curriculum. Where the educational institutions' website provided an email address to contact the lecturer, the invitation to participate in the survey was also sent to that address.

***Selection of practitioners for the sample***

To compose the sample subgroup of practitioners, a list was used consisting of 1,300 Operations Management professionals, primarily represented by managers, supervisors or production coordinators who work in automotive companies, generally suppliers of major automakers, with industrial plants located in Brazil. The professionals are part of a registry created by the authors over recent years. This sample subgroup is justified by the belief that companies operating in the automotive industry have a mature Operations Management process as a result of high expectations for their day-to-day performance and through compliance with the numerous quality standards required by automakers.

## 3.2 DATA COLLECTION PROCEDURES

### *Procedures for collecting data from lecturers and researchers*

The procedure used for data collection in this study followed the data collection methodology recommended by Graeml and Csillag (2008). According to them, incorporating the Internet into routine work makes it easier to use the conveniences provided by the web to conduct data collection through questionnaires.

For the pilot procedure, an invitation was sent via email with a link to the survey available on SurveyMonkey – a website that specializes in implementing electronic questionnaires through the web – to 70 lecturers randomly chosen from among those who met the criteria discussed in item 3.1. This invitation, or the subsequent reminder email or even a thank-you one, triggered the participation of 36 lecturers.

The results of the pilot test provided no reason for changes in the data collection instrument or the procedure for sending the invitation; therefore, the exact same procedure was followed for the 36 researchers and remaining 180 lecturers, obtaining 67 additional replies.

Summing the questionnaires returned by the pilot group and the main sample, which was possible because no changes were required in the procedure or content of the questionnaire, 103 completed questionnaires were obtained.

Taking into account that 286 emails were sent, with seven returned as undelivered to reduce the number of possible respondents to 279, the return rate was approximately 37%, which is considered to be quite satisfactory. The fact that the sample involved lecturers and researchers accustomed to the academic environment, where this type of study is commonly conducted, may have contributed to the higher than usual return rate.

During the data collection process, 35 respondents returned the emails expressing thanks for the invitation and confirming that the survey had been completed. In addition, 87 of the participants responded affirmatively to the last question, which asked if they would like to receive the study results, which is also evidence that participants were interested in the study.

### *Procedures for collecting data from practitioners*

An email containing an invitation with a link to the study on SurveyMonkey was sent to practitioners registered in the database (approx. 1,300). Unfortunately, approximately five

hundred of these emails were returned as unable to be delivered to recipients, which reduced the number of possible respondents to just over 800. A total of 104 full surveys were obtained, representing 12.7% of the potential respondents; this rate was still considered satisfactory. Table 1 summarizes the return rates obtained for each stratum of the sample.

**Table 1 - Obtained Return Rates**

| Sample stratum | Sample Size | Respondents | Return rate |
|---|---|---|---|
| Most prolific authors | 36 | 12 | 33.3% |
| Most prolific higher education institutions | 61 | 24 | 39.3% |
| Programs with CPC = 5 | 137 | 56 | 40.9% |
| Programs with CPC = 3 | 52 | 11 | 21.2% |
| Total lecturers and researchers | 286 | 103 | 36.0% |
| Practitioners | 820 | 104 | 12.7% |
| Overall total | 1,106 | 207 | 18.7% |

Source: the authors, based on the study data

## 3.3 PROCEDURES FOR DATA PROCESSING AND ANALYSIS

The data on an ordinal scale of responses (from "little important" to "extremely important") were converted to an interval scale, from 1 to 7, to allow the calculation of mean values. This procedure has been used in studies based on Likert-scale questionnaires for ease of analysis.

The data obtained in the study were statistically analyzed using SPSS software (Statistical Package for the Social Sciences), version 15. Firstly, a descriptive analysis of each of the 45 quantitative variables was performed through EDA (Exploratory Data Analysis), which basically consists of exploring the data through graphical techniques, as recommended by Dancey and Reidy (2006) and Field (2009). Then, a factor analysis was used to verify the robustness of the constructs and confirm the dimensions (thematic categories) for Operations Management. Principal component analysis was used to extract factors, and sampling adequacy was assessed using the Kaiser-Meyer-Olkin (KMO) and Bartlett's sphericity tests. The factor analysis was complemented with varimax rotation, to make the variables more "loaded" on specific factors, thus facilitating their interpretation (DANCEY; REIDY, 2006; HAIR JR. *et al.*, 2005). Variables with factor loadings of less than 0.4 were excluded from the study. No variable had a negative loading factor that needed to be interpreted in a reverse way. After defining which variables fell into each factor, the reliability of the generated factors was evaluated using Cronbach's alpha. The variables that reduced the reliability of the scale were discarded.

## 4 ANALYSIS AND CONFIRMATION OF THE DIMENSIONS OF THE OPERATIONS MANAGEMENT THEMES

Considering that there were no significant differences detected in the importance assigned to the different Operations Management themes, based on the stratification of respondents into researchers, lecturers and practitioners, it was decided not to perform this discrimination when analyzing the dimensions (themes) of Operations Management. Thus, all 207 responses in the survey were considered in the exploratory factor analysis, which sought to ensure that the responses given to questions that related to subjects associated with the same theme had a clear pattern, as it would be expected.

An analysis of the frequency histograms and box plots generated allowed all 45 interval type variables of the set to be considered acceptable. Table 2 shows the results of the exploratory factor analysis. The Bartlett's sphericity test (p -value < 0.001) tests the hypothesis that the correlation matrix is the identity matrix, whose determinant is equal to one (FIELD, 2009). Such test is used to analyze the correlation matrix as a whole. The fitting of the sample to each of the individual factors can be assessed using the Kaiser-Meyer-Olkin test (KMO = 0.886). The KMO test checks the value of the correlation among variables. If the value is insufficient, i.e., KMO is close to zero, the use of a factor analysis technique may be unsuitable. On the other hand, if the value is close to one, factor analysis may be correctly employed (DANCEY; REIDY, 2006; HAIR JR. *et al.*, 2005). These results allow the use of factor analysis as an exploratory technique for the intended study.

From the 45 items originally used in the questionnaire, four (variables 1, 2, 7 and 21) contributed negatively to the reliability of the factors they were related to, and thus they were discarded. According to the interpretation criteria and varimax rotation, nine factors were adopted, with a total explained variance of 70.47%. Table 2 shows in detail the resulting factor structure.

**Table 2 - Matrix with Variables from the Mapping of Obtained Themes and Factors**

| VARIABLES OF THE CONSOLIDATED MAPPING OF THEMES IN OPERATIONS MANAGEMENT | | OBTAINED FACTORS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | Factor 7 | Factor 8 | Factor 9 |
| 1. Operations Strategy | | | | | | | | | | |
| 1 | Production strategies and policies* | 0.43 | 0.31 | 0.24 | 0.10 | 0.17 | 0.15 | -0.12 | 0.22 | -0.32 |
| 2 | Global operations management * | -0.08 | 0.58 | 0.22 | 0.08 | 0.20 | 0.24 | 0.20 | 0.18 | -0.02 |
| 2. Routine Operations Management | | | | | | | | | | |
| 3 | Production and process management | **0.66** | 0.27 | 0.02 | 0.02 | 0.14 | 0.17 | 0.24 | 0.21 | -0.11 |
| 4 | Production Control and Planning (PCP) | **0.72** | 0.28 | -0.08 | -0.01 | 0.07 | 0.03 | 0.34 | 0.02 | 0.09 |
| 5 | Performance and productivity measurement | **0.57** | 0.14 | 0.19 | 0.00 | -0.04 | 0.01 | 0.42 | 0.18 | 0.04 |
| 6 | Planning and capacity analysis | **0.74** | 0.29 | 0.15 | 0.17 | 0.05 | 0.00 | 0.11 | 0.00 | 0.05 |
| 7 | Operating costs accounting * | 0.15 | 0.26 | 0.56 | 0.01 | 0.18 | 0.02 | 0.26 | -0.27 | 0.20 |
| 8 | Operations information management | **0.62** | 0.09 | 0.32 | 0.05 | 0.03 | 0.25 | 0.02 | -0.09 | 0.15 |
| 9 | Location of plants, project and layout | **0.42** | 0.28 | 0.05 | 0.17 | 0.26 | 0.26 | 0.12 | 0.12 | 0.13 |
| 3. JIT - Lean Manufacturing | | | | | | | | | | |
| 10 | Lean production systems (includes JIT, Theory of Constraints - TOC) | **0.71** | 0.25 | 0.09 | 0.15 | 0.24 | 0.14 | -0.01 | 0.00 | 0.01 |
| 11 | Flexible manufacturing systems | **0.68** | 0.10 | 0.05 | 0.17 | 0.11 | 0.30 | -0.06 | 0.01 | 0.10 |
| 12 | Computer integrated manufacturing (CIM) automation – Computer aided design (CAD) /CAM (Computer Aided Manufacture) | 0.16 | -0.06 | 0.21 | 0.10 | 0.10 | 0.29 | 0.21 | 0.06 | **0.68** |
| 4. Quality Management | | | | | | | | | | |
| 13 | Quality management | 0.20 | 0.00 | 0.26 | 0.22 | 0.22 | 0.24 | **0.65** | 0.13 | 0.18 |
| 14 | Total quality management | 0.14 | 0.07 | 0.20 | 0.24 | 0.04 | 0.13 | **0.80** | 0.12 | -0.04 |
| 15 | Quality standardization and certification | 0.16 | 0.05 | 0.27 | 0.26 | 0.19 | 0.17 | **0.70** | -0.14 | 0.04 |
| 5. Logistics and Supply Chain | | | | | | | | | | |
| 16 | Logistics, transport and distribution | 0.24 | **0.77** | 0.03 | 0.18 | 0.15 | 0.02 | 0.04 | 0.06 | -0.07 |
| 17 | Materials and stock management | 0.43 | **0.67** | 0.04 | 0.15 | 0.04 | 0.06 | 0.19 | 0.01 | 0.01 |
| 18 | Purchase and supply systems | 0.32 | **0.76** | 0.12 | -0.05 | 0.08 | 0.12 | 0.12 | -0.04 | 0.01 |
| 19 | Supply chain management | 0.22 | **0.76** | 0.13 | 0.06 | 0.16 | -0.06 | 0.08 | 0.15 | 0.05 |
| 20 | Demand management | 0.38 | **0.68** | 0.21 | 0.17 | -0.05 | -0.10 | -0.07 | 0.03 | 0.07 |
| 21 | International logistics and global sourcing* | - | 0.60 | 0.19 | 0.17 | 0.07 | 0.09 | -0.14 | 0.10 | 0.39 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.05 | | | | | | | | |
| 22 | Logistics strategies and practices | 0.32 | **0.59** | 0.26 | 0.19 | -0.01 | 0.16 | -0.16 Â | 0.21 | -0.13 |
| 6. Ergonomics and Work Organization | | | | | | | | | | |
| 23 | Project, measurement and improvement of work | 0.33 | 0.14 | **0.59** | 0.11 | 0.07 | 0.20 | 0.30 | 0.19 | 0.09 |
| 24 | Behavioral aspects and HR in operations | 0.15 | 0.26 | **0.69** | 0.13 | 0.15 | 0.28 | 0.18 | 0.00 | -0.04 |
| 7. Environmental Sustainability of Operations | | | | | | | | | | |
| 25 | Regulatory and environmental issues in operations | 0.03 | 0.17 | **0.81** | 0.22 | 0.17 | 0.13 | 0.16 | 0.12 | 0.02 |
| 26 | The role of operations in sustainability | 0.09 | 0.18 | **0.72** | 0.32 | 0.15 | 0.16 | 0.14 | 0.31 | 0.07 |
| 27 | Sustainable business strategies | 0.08 | 0.14 | **0.67** | 0.22 | 0.19 | 0.18 | 0.09 | 0.32 | 0.16 |
| 28 | Sustainable supply chains and reverse logistics | 0.12 | 0.19 | 0.33 | 0.15 | 0.19 | -0.05 | -0.03 | **0.59** | 0.20 |
| 8. Project Management and Product Development | | | | | | | | | | |
| 29 | Project management | 0.23 | 0.17 | 0.32 | 0.00 | **0.62** | 0.00 | 0.16 | 0.33 | 0.12 |
| 30 | Product design and development | 0.20 | 0.09 | 0.16 | -0.04 | **0.77** | 0.19 | 0.18 | 0.13 | 0.11 |
| 31 | Manufacturing projects | 0.44 | -0.03 | 0.00 | 0.07 | 0.12 | **0.68** | 0.14 | 0.19 | 0.02 |
| 9. Innovation and Technology Management | | | | | | | | | | |
| 32 | Operations technology strategy and management | 0.25 | 0.11 | 0.19 | 0.07 | 0.16 | **0.67** | 0.26 | 0.16 | 0.15 |
| 33 | Group technology | 0.08 | 0.13 | 0.15 | 0.20 | 0.01 | **0.68** | 0.09 | -0.04 | 0.22 |
| 34 | Technological management/organizational change | 0.15 | 0.01 | 0.36 | 0.19 | 0.25 | **0.68** | 0.08 | -0.05 | 0.08 |
| 35 | E-business and operations | 0.10 | 0.13 | 0.05 | 0.19 | 0.15 | 0.31 | -0.06 | 0.25 | **0.68** |
| 36 | Technological innovation | 0.15 | 0.09 | 0.24 | 0.18 | 0.47 | **0.56** | 0.06 | 0.05 | 0.18 |
| 10. Service Operations | | | | | | | | | | |
| 37 | Service operations strategies | 0.08 | 0.20 | 0.12 | 0.35 | 0.13 | 0.25 | 0.12 | **0.70** | 0.08 |
| 38 | Service operations management | 0.03 | 0.21 | 0.14 | **0.58** | 0.18 | 0.00 | 0.24 | 0.55 | 0.12 |
| 39 | Lean production in services | 0.17 | 0.06 | 0.12 | **0.76** | 0.10 | 0.18 | 0.05 | 0.24 | 0.21 |
| 40 | Quality in service operations | 0.13 | 0.24 | 0.21 | **0.70** | 0.11 | 0.17 | 0.31 | 0.19 | 0.04 |
| 41 | Logistics in service operations | 0.11 | 0.38 | 0.22 | **0.70** | 0.04 | 0.10 | 0.28 | 0.19 | 0.05 |
| 42 | Ergonomics in service operations | 0.28 | 0.05 | 0.28 | **0.60** | 0.30 | 0.19 | 0.24 | -0.15 | 0.04 |
| 43 | Sustainability of service organizations | 0.11 | 0.08 | 0.31 | **0.60** | 0.52 | 0.18 | 0.06 | 0.05 | 0.01 |
| 44 | Projects and development of new services | 0.08 | 0.15 | 0.13 | 0.44 | **0.73** | 0.15 | 0.04 | 0.10 | 0.00 |
| 45 | Management of innovation and technology in services | 0.07 | 0.19 | 0.12 | 0.48 | **0.69** | 0.17 | 0.03 | -0.04 | 0.02 |

* Variables excluded from the factor analysis
Source: the authors, based on the study data

In summary, nine groupings emerged from the factor analysis; the first seven factors have a composition structure for their variables quite close to the proposal in the consolidated mapping table presented by Peinado and Graeml (2013). The data shown in Table 2 indicate

that only four variables were not incorporated into the initially proposed themes, and eventually formed two new thematic sets: factor 8, which grouped the variables 28 and 37, was called *Service strategy* and *sustainable supply chains*, and factor 9, which grouped variables 12 and 35, was named *Information technology for Operations Management*. It is also observed that the variables related to the *Routine operations management* and *Lean Manufacturing* themes were combined into a single factor; the same occurred with the variables of the themes *Ergonomics and work organization* and *Environmental sustainability of operations*. Variable 31, *Manufacturing project*, did not remain in factor 5, related to *Operations management and product development*, but joined factor 6, which addresses *Innovation and technology management*. It is possible that the respondents related *Manufacturing project* with the technology employed for the manufacture of the product, which would explain the repositioning of variable 31.

Table 3 shows the results of the descriptive statistics and complements the results of the factor analysis; it displays the mean obtained for the factors, the cumulative variances, the index of internal consistency (Cronbach's alpha) and Pearson's correlations with the other factors. Cronbach's alpha is used to measure the reliability of the constructs, i.e., the internal consistency of responses given by different respondents with respect to the same construct (FIELD, 2009).

**Table 3 - Descriptive Statistics and Correlations Extracted from the Factor Analysis**

| Factor | Mean | Cumulative variance | Cronbach's alpha | Factors | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | 6.01 | 11.25% | 0.894 | 0.59** | 0.45** | 0.48** | 0.44** | 0.54** | 0.49** | 0.34** | 0.36** |
| 2 | 6.02 | 22.25% | 0.895 | | 0.44** | 0.44** | 0.38** | 0.33** | 0.25** | 0.41** | 0.20** |
| 3 | 5.30 | 31.38% | 0.907 | | | 0.63** | 0.56** | 0.59** | 0.57** | 0.53** | 0.40** |
| 4 | 5.37 | 40.77% | 0.899 | | | | 0.65** | 0.57** | 0.58** | 0.58** | 0.46** |
| 5 | 5.32 | 48.21% | 0.843 | | | | | 0.55** | 0.45** | 0.50** | 0.39** |
| 6 | 5.02 | 55.59% | 0.845 | | | | | | 0.50** | 0.41** | 0.56** |
| 7 | 5.44 | 61.96% | 0.857 | | | | | | | 0.33** | 0.38** |
| 8 | 5.60 | 66.84% | 0.647 | | | | | | | | 0.41** |
| 9 | 4.59 | 70.47% | 0.650 | | | | | | | | |

Significance level: **< 0.01
Source: the authors, based on the study data

As shown, the first seven factors had a Cronbach's alpha higher than 0.8. Only the last two factors had values close to 0.65, which were still considered to be satisfactory for the purposes of this study. Together, the nine factors explain 70.47% of the cumulative variance. Such figures indicate the validity of using the generated factors to replace the variables they represent.

The result shows that the mapping of Operations Management themes obtained through the factor analysis is well aligned with the mapping of themes previously obtained by Peinado and Graeml (2013) who had analyzed the editorial space provided by journals and conferences addressing that area; the Peinado and Graeml (2013) mapping served as a basis for the preparation of the survey questionnaire. The factor analysis allowed that mapping to be enhanced, with the proposition of a new version for the consolidated mapping of Operations Management themes, as shown in Table 4.

| | |
|---|---|
| 1. Routine operations management and lean manufacturing | |
| 1.1 | Production and process management |
| 1.2 | Operations PCP |
| 1.3 | Performance and productivity measurement |
| 1.4 | Planning and capacity analysis |
| 1.5 | Operations information management |
| 1.6 | Location of plants, project and layout |
| 1.7 | Lean production systems (includes JIT, TOC) |
| 1.8 | Flexible manufacturing systems |
| 2. Quality management | |
| 2.1 | Quality management |
| 2.2 | Total quality management |
| 2.3 | Quality standardization and certification |
| 3. Logistics and supply chain | |
| 3.1 | Logistics, transport and distribution |

| | |
|---|---|
| 3.2 | Materials and stock management |
| 3.3 | Purchase and supply systems |
| 3.4 | Supply chain management |
| 3.5 | Demand management |
| 3.6 | Logistics strategies and practices |
| 4. Work organization and environmental sustainability | |
| 4.1 | Project, measurement and improvement of work |
| 4.2 | Behavioral aspects and HR in opera |
| 4.3 | Regulatory and environmental issues in operations |
| 4.4 | The role of operations in sustainability |
| 4.5 | Sustainable business strategies |
| 5. Project management and product development | |
| 5.1 | Project management |
| 5.2 | Project and product development |
| 5.3 | Projects and development of new services |
| 5.4 | Innovation and technology management in services |
| 6. Innovation and technology management | |
| 6.1 | Operations strategy and technology management |
| 6.2 | Group technology |
| 6.3 | Technological management/organizational change |
| 6.4 | Technological innovation |
| 6.5 | Manufacturing project |
| 7. Service Operations | |
| 7.1 | Operations management in services |

| | |
|---|---|
| 7.2 | Lean production in services |
| 7.3 | Quality in service operations |
| 7.4 | Logistics in service operations |
| 7.5 | Ergonomics in service operations |
| 7.6 | Sustainability of service organizations |
| 8. Service strategy and sustainable supply chains | |
| 8.1 | Strategies for service operations |
| 8.2 | Sustainable supply chains and reverse logistics |
| 9. Information technology for operations management | |
| 9.1 | CIM Automation - CAD/CAM |
| 9.2 | E-business and operations |

Table 4 - New proposal for the mapping of Operations Management themes
Source: authors, based on the study results

## 5 FINAL CONSIDERATIONS

Starting with the objective of analyzing the importance attributed to Operations Management themes through a direct approach to researchers, lecturers and practitioners, it was possible to make an interesting contribution to academia and to company management. This contribution consists of the empirical identification of nine thematic categories through a factor analysis, representing a refinement of the thematic map presented in a previous paper published at REGE (Revista de Gestão da USP) in 2013 (PEINADO; GRAEML, 2013). These nine categories are (1) Operations management and lean manufacturing, (2) Logistics and supply chain, (3) Work organization and environmental sustainability, (4) Service Operations; (5) Management and development of projects, products and services, (6) Innovation and technology management, (7) Quality management, (8) Service strategy and sustainable supply chains, and (9) Information technology for production management. Therefore, the proposal to improve the consolidated mapping of Operations Management themes resulting from this work contributes to a better understanding of what researchers, lecturers and practitioners in the area perceive to be relevant and how they think that the themes relate to each other.

Despite the interesting results obtained, this study has limitations that reduce the scope of its conclusions. The primary limitation is related to the adopted method: when a questionnaire that depends on the individual's willingness to participate is adopted, it is not possible to state categorically that the respondents are representative of the population (from a statistical point of view) because the non-respondents may perceive the studied phenomenon in a distinct manner. This potential bias means that caution is required when making inferences. Even so, although no additional test has been performed to ensure the sample representativeness, the authors cannot foresee any reason for response bias, i.e., differences between respondents and non-respondents, regarding the subject of the present study.

Regardless of the methods and approaches adopted to classify the themes related to Operations Management and the conclusions that can be drawn from them, it is important that initiatives such as this continue to occur.

The study by Peinado and Graeml (2013) represented a step toward a deeper reflection on what is relevant to the Operations Management academic community. The present paper advances in this discussion: in addition to the journal editors' perspective, it includes the vision of those involved with teaching, researching and practicing the concepts of the area. However, this study only represents a further step toward the understanding of how various Operations Management professionals can contribute to our society, by exploring new concepts that can make organizations more productive, by training the next generations of Operations Management professionals or by operating in the business practice. A next step that can be taken based on the data that were already collected for the current work is to contrast the views of researchers, lecturers and practitioners about the importance they assign to the themes of Operations Management. As it was said, the difference was not perceived to be huge, which allowed us to treat the data all together for the analysis that was carried out for this paper. However, there are some particularities that surely deserve some additional analytical effort, to provide us with interesting results. The discussion of eventual differences in perspectives could help researchers, lecturers and practitioners to better understand the diversity of objectives and work challenges faced by different professionals who deal with Operations Management concepts in their daily professional lives, in addition to making Operations Management more relevant to their organizations and society as a whole.

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## APPENDIX – QUESTIONNAIRE USED IN DATA COLLECTION

Please, draw a circle around the number in the scale that best represents your opinion with respect to the importance of each of the suggested themes to your professional activities. Leave it blank when you do not have a formed opinion or when you do not know the topic.

The scale goes from 1 = little important to 7 = extremely important.

| THEME | Little important | | | | | | Extremely important |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. Operations strategy | | | | | | | |
| Production strategies and policies | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Global operations management | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2. Routine operations management | | | | | | | |
| Production and process management | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Production Control and Planning (PCP) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Performance and productivity measurement | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Planning and capacity analysis | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Operating costs accounting | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Operations information management | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Location of plants, project and layout | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3. JIT – Lean manufacturing | | | | | | | |
| Lean production systems (includes JIT, Theory of Constraints - TOC) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Flexible manufacturing systems | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Computer integrated manufacturing (CIM) automation – Computer aided design (CAD) /CAM (Computer Aided Manufacture) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Quality Management | | | | | | | |
| Quality management | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Total quality management | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Quality standardization and certification | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Please, draw a circle around the number in the scale that best represents your opinion with respect to the importance of each of the suggested themes to your professional activities. Leave it blank when you do not have a formed opinion or when you do not know the topic.

The scale goes from 1 = little important to 7 = extremely important.

| THEME | Little important | | | | | | Extremely important |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. Logistics and supply chain | | | | | | | |
| Logistics, transport and distribution | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Materials and stock management | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Purchase and supply systems | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Supply chain management | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Demand management | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| International logistics and global sourcing | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Logistics strategies and practices | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Ergonomics and work organization | | | | | | | |
| Project, measurement and improvement of work | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Behavioral aspects and HR in operations | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. Environmental sustainability of operations | | | | | | | |
| Regulatory and environmental issues in operations | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| The role of operations in sustainability | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sustainable business strategies | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sustainable supply chains and reverse logistics | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. Project management and product development | | | | | | | |
| Project management | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Product design and development | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Manufacturing projects | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. Innovation and technology management | | | | | | | |
| Operations technology strategy and management | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Please, draw a circle around the number in the scale that best represents your opinion with respect to the importance of each of the suggested themes to your professional activities. Leave it blank when you do not have a formed opinion or when you do not know the topic.

The scale goes from 1 = little important to 7 = extremely important.

| THEME | Little important | | | | | | Extremely important |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Group technology | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Technological management/organizational change | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| E-business and operations | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Technological innovation | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. Service operations | | | | | | | |
| Service operations strategies | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Service operations management | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Lean production in services | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Quality in service operations | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Logistics in service operations | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Ergonomics in service operations | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sustainability of service organizations | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Projects and development of new services | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Management of innovation and technology in services | 1 | 2 | 3 | 4 | 5 | 6 | 7 |